

# Enzymes

## Mark Scheme 1

<b>Level</b>	IGCSE
<b>Subject</b>	Biology
<b>Exam Board</b>	CIE
<b>Topic</b>	Enzymes
<b>Paper Type</b>	(Extended) Theory Paper
<b>Booklet</b>	Mark Scheme 1

**Time Allowed:** 63 minutes

**Score:** /52

**Percentage:** /100

<p><b>1 (a)</b></p>	<p><i>full marks may be possible from a fully annotated genetic diagram</i></p> <p>females are XX, males are XY ;</p> <p>female gametes are X, male gametes are X or Y ;</p> <p>ref to random fusion of gametes / shown in a Punnett square or alternative ;</p> <p>1:1/50:50/ described, shown/ stated ;</p>	<p>[4]</p>	
<p><b>(b)</b></p>	<p>ref to, identify/ separate, sperm with X (chromosome) ;</p> <p>semen/ sperm, inserted/injected, into, uterus/ oviduct ;</p> <p>at/ around time of, ovulation/ AW ;</p>	<p>max [2]</p>	
<p><b>(c)</b></p>	<p><b>1</b> formula milk is, similar/ closer in composition, to human milk ;</p> <p><b>2</b> any nutrient with similar quantities in formula and human milk ;</p> <p><b>3</b> <i>idea that</i> human milk meets requirements of human babies ;</p> <p><i>comparisons with cow's milk</i></p> <p><b>4</b> formula supplies less protein which is harder to digest ;</p> <p><b>5</b> formula supplies more iron, for haemoglobin formation/ to prevent anaemia ;</p> <p><b>6</b> formula supplies more vitamin D for, absorption of calcium/ formation of bone/ for strong bones/ prevention of rickets ;</p> <p><b>7</b> formula supplies more vitamin A, for immune system/ retina/ rods/ vision in dim light/ prevention of night blindness ;</p> <p><b>8</b> use of comparative figures <u>with correct units</u> ;</p>	<p>max [4]</p>	
<p><b>(d)</b></p>	<p>biological/ made by cells ;</p> <p>catalyst/ speeds up the rate of a reaction ;</p> <p>made of protein ;</p>	<p>max [2]</p>	

<p>1 (e)</p>	<p><b>tubes 1 and 3 – the effect of pH</b></p> <p>1 lysozyme is active in, 1/pH 4.0/acid ;</p> <p>2 <u>cell walls</u>, broken down/digested/destroyed in tube 1 ;</p> <p>3 no (bacterial) growth in tube 1 ;</p> <p><b>tubes 1 and 4 – the effect of type of bacteria</b></p> <p>4 lysozyme, destroys /AW, bacteria, <b>A</b>/in tube 1 ;</p> <p>5 lysozyme does not, destroy /AW, bacteria, <b>B</b>/in tube 4 ;</p> <p>6 ref to specificity to bacteria <b>A</b>/bacteria <b>B</b> is resistant ; <b>ignore</b> bacteria are immune</p> <p>7 <i>idea that</i> nothing in (cell wall of) bacteria <b>B</b> for lysozyme to digest ;</p> <p><b>tubes 1 and 2 – the effect of boiling</b></p> <p>8 lysozyme denatured (by boiling) ;</p> <p>9 lysozyme not, active ;</p> <p>10 <i>idea that</i> tube 2 is a control to show that lysozyme is responsible for no growth in tube 1 ;</p>	<p>max [6]</p>	
<p>(f)</p>	<p>1 gives (passive) <u>immunity</u> ;</p> <p>2 defends against, infection/illness/disease/pathogens /AW ;</p> <p>3 ref to diseases that the mother has had ;</p> <p>4 any one function of antibodies ;</p>	<p>max [2]</p>	

2 (a)	<p><u>lock and key</u> mechanism;  substrate fits into enzyme;  (shape of) substrate is complementary to, enzyme/active site;  ref to active site;  substrate breaks/product(s) forms/product(s) leaves enzyme;  enzyme, free for next reaction/not used up/remains unchanged;  AVP;</p>	max 3	e.g. lowers activation ener
(b)	(cellulose) <u>cell wall</u> ;	1	
(c) (i)	<p>protease activity, similar/AW, on both sites;  all enzyme activity is, greater/better/faster, in site <b>A</b>;  cellulase activity on site <b>A</b> greater than protease activity on site <b>A</b>;  cellulase activity, higher on site <b>A</b>, than site <b>B</b>/ORA;  cellulase and protease activity on site <b>B</b> similar;  use of data with units to support any of these marking points;</p>	max 3	do not award data quote unqualified
(ii)	<p>pH/water content, no effect on protease activity;  cellulase more active, at higher pH/less acidic environment;  cellulase more active, at lower soil moisture;  ref to <u>optimum</u> pH of, protease/cellulase/enzymes;  low pH may denature cellulase;  idea of different leaf composition;  size of leaves/surface area/species of leaf;  different stage of decomposition;</p>	max 3	

2 (d)	<p>1 ref to, decomposers/bacteria/fungi;                  2 proteins are broken down to amino acids;                  3 by proteases;                  4 amino acids converted to, ammonia/ammonium (ions);                  5 deamination;                  6 ammonia/ammonium ions, converted to nitrite ions;                  7 nitrites converted to nitrate ions;                  8 nitrification/oxidation/nitrifying bacteria;                  9 nitrate ions absorbed by plants;</p>	max 3	<p>protease is linked to <b>MP2</b></p> <p>ammonia to nitrate = 1 <b>A</b> nitrites  <b>A</b> nitrates                  ammonia to nitrite and then to nitrate = 2  <b>A</b> nitrates</p>
(e) (i)	<u>nitrogen fixation</u> ;	1	
(ii)	<p>root nodules (on legumes);                  free living bacteria;  <u>nitrogen-fixing bacteria</u>;                  nitrogen, converted to, ammonium/ammonia/amino acids;</p>	max 2	<p>1 lightning</p> <p>1 nitrate(s)                  1 nitrification/nitrifying bacteria</p>
		<b>[Total: 17]</b>	

3 (a) (i)	1 2 3 4	without enzymes reactions, occur too slowly / not at all ; <b>A</b> enzymes speed up reactions reduce, activation energy / energy needed for a reaction ; reactions take place at lower temperatures ; enzymes are catalysts ;	[max 3]	<b>MP1 A</b> some aspect of metabolism as an alternative to reactions, e.g. digestion
	(ii)	lipase – pancreas ; protease – stomach / pancreas ; amylase – salivary gland / pancreas ;	[3]	organs have to be different if the answer for lipase is incorrect <b>A</b> pancreas for either protease or amylase but not both
(b) (i)		control ; <b>R</b> control(led) variable to show differences in, colour / pH / fat, due to, enzyme / lipase ;  to use for comparing, colours / pH ;	[max 2]	<b>A</b> to show what happens without, enzyme / lipase, and bile salts
	(ii)	acid pH / below pH 5 / lowers the pH / becomes acidic ; fat has been, digested / broken down ; fatty acids (and glycerol) ;	[3]	<b>R</b> ref to lipase / bile salts being acidic

3	(iii)	1	<p>ref to specific, pH / colour in, <b>B / C</b> ;                      i.e. <b>B</b> is blue / 8-10 / alkaline                      i.e. <b>C</b> is yellow / 4-5 / slightly acid</p> <p><b>ignore</b> bile salts / lipase is alkaline in <b>B</b></p> <p><b>B</b>                      2 no, (chemical) digestion / breakdown (of fat) ;                      3 no fatty acids ;                      4 no lipase ;</p> <p><b>C</b>                      5 some, (chemical) digestion / breakdown (of fat) ;                      6 fat not <u>emulsified</u> ;                      7 so slower reaction (than A) ;                      8 fewer fatty acids produced ;</p> <p><i>award for <b>B / C</b></i>                      9 bile salts <u>emulsify</u> fats ;                      10 ref to increasing surface area of fat (globules / AW) ;                      11 bile salts are not enzymes ;</p>	[max 4]	<table border="1"> <thead> <tr> <th>test-tube</th> <th>contents</th> <th>colour of pH indicator after 5 minutes at 40 °C</th> </tr> </thead> <tbody> <tr> <td><b>A</b></td> <td>milk, alkaline solution, lipase and bile salts</td> <td>orange</td> </tr> <tr> <td><b>B</b></td> <td>milk, alkaline solution, bile salts and water</td> <td>blue</td> </tr> <tr> <td><b>C</b></td> <td>milk, alkaline solution, lipase and water</td> <td>yellow</td> </tr> <tr> <td><b>D</b></td> <td>milk, alkaline solution and water</td> <td>blue</td> </tr> </tbody> </table>			test-tube	contents	colour of pH indicator after 5 minutes at 40 °C	<b>A</b>	milk, alkaline solution, lipase and bile salts	orange	<b>B</b>	milk, alkaline solution, bile salts and water	blue	<b>C</b>	milk, alkaline solution, lipase and water	yellow	<b>D</b>	milk, alkaline solution and water	blue
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